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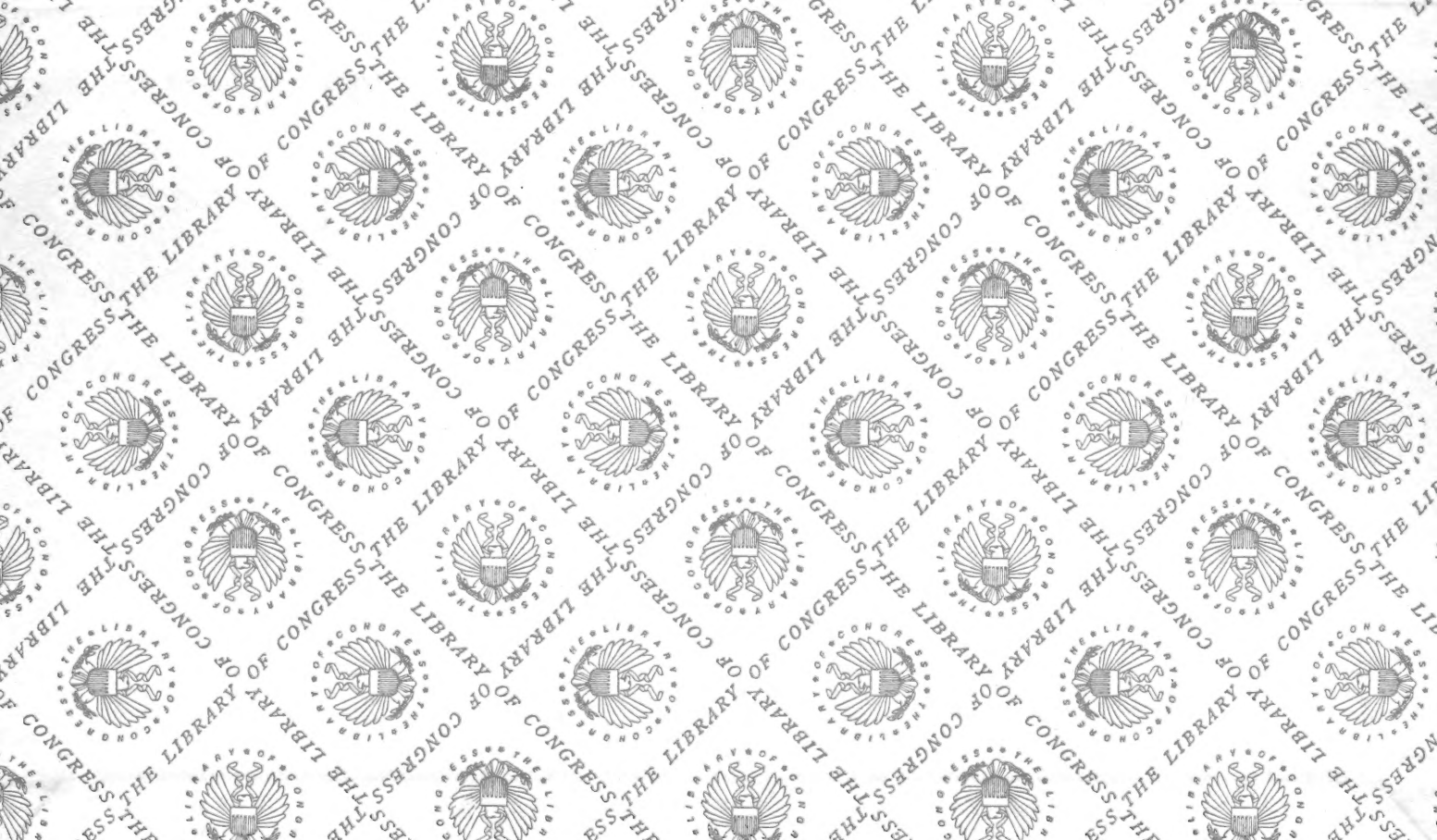
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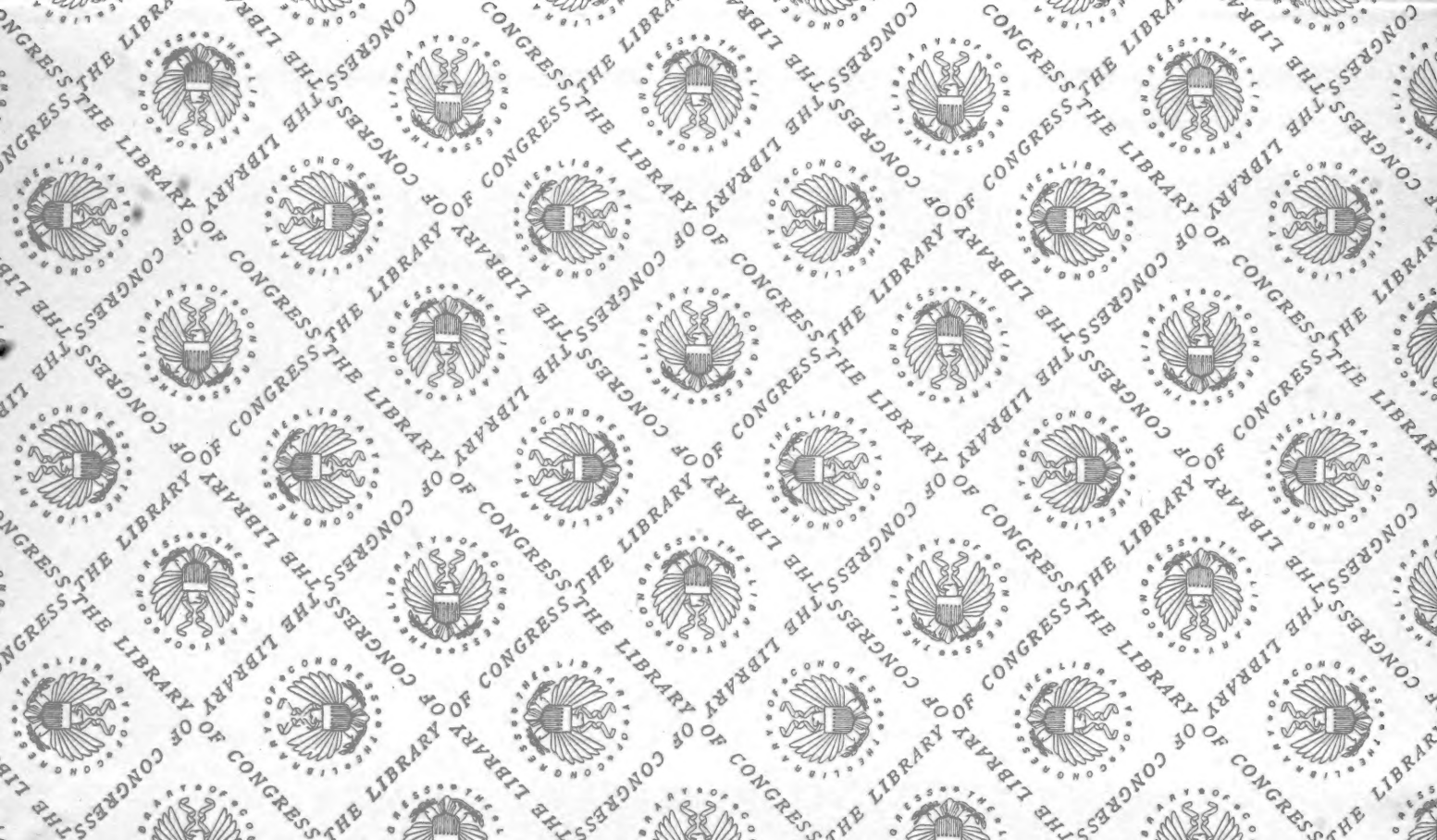
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REPORT

MADE TO THE

BEET SUGAR SOCIETY

OF PHILADELPHIA,

ON THE CULTURE, IN FRANCE, OF THE BEET ROOT, AND MANUFACTURE OF SUGAR THEREFROM; WITH MISCELLANEOUS REMARKS ON THE SAME, AND ON THE CULTURE OF THE POPPY, AND EXTRACTION OF SALAD OIL FROM THE SEED; FOR THE PURPOSE OF INTRODUCING, AND PERMANENTLY ESTABLISHING THESE VALUABLE BRANCHES OF AGRICULTURE AND MANUFACTURE IN THE UNITED STATES.

BY

JAMES PEDDER

AGENT OF THE SOCIETY.

PUBLISHED BY

THE BEET SUGAR SOCIETY OF PHILADELPHIA.

C. SHERMAN & CO., PRINTERS.

1836.

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ENTERED, according to the Act of Congress, in the year 1836, by JACOB SNIDER, junior, Secretary and Treasurer of the "Beet Sugar Society," in the Clerk's office of the District Court for the Eastern District of Pennsylvania.

PREFACE.

In presenting to the public the report of their agent, the "*Beet Sugar Society*" deem it proper that the objects for which the Society has been formed, as well as the circumstances, which led to its formation, should be clearly set forth in this publication. James Ronaldson, Esq. the president of the Society, had for some years reflected upon, and given attention to the subject of introducing the sugar beet culture, and the manufacture of sugar therefrom into the United States. Through the instrumentality of John Vaughan, Esq., and the exertions of the present secretary of the Society, Mr. Ronaldson was made acquainted with Mr. James Pedder, a gentleman who had, both here and in Europe, given attention to the subject, and who had watched with interest the progress of the French in perfecting the manufacture of beet sugar; and having suggested to Messrs. Vaughan and Snider, the benefits that might eventually accrue to this country from its introduction, he was selected as the agent, to make a voyage to France, for the purpose of acquiring practical knowledge in these very important branches of agriculture and manufacture, in order to ensure their permanent and successful establishment in the United States. In the early part of January, 1836, Messrs. Ronaldson, Vaughan, and Snider, decided to take upon themselves the expense and risk of employing and commissioning Mr. Pedder to proceed to France for the above-

mentioned purpose, relying upon their fellow-citizens for reimbursement of the expenses incurred. By an agreement made between them and Mr. Pedder, on the 6th day of February, 1836, (a copy of which is appended to this report,) the latter set forth on his mission on the 8th day of February last. From that period, the increased interest manifested on the subject throughout the country, has been the means of augmenting the number of donors to the expense of the undertaking. On the 16th day of May last, a meeting of the contributors was held, at which, information received from Mr. Pedder was submitted to them. It was then deemed expedient and proper, "*for the purpose of introducing into the United States, the culture of the* SUGAR BEET, *and the manufacture of sugar from the same;*" to organize a society having this for its object, and accordingly a society was formed, and a board of managers appointed to carry the same into effect. By the efforts of this society, a great interest has been excited in every portion of the country, from Louisiana to Maine, as the public prints and various inquiries testify. In the latter part of May, about 600 pounds of seed of the true sugar beet, were purchased and transmitted to Philadelphia, by the society's agent, then in France. The greater portion of this seed has been extensively distributed over the country, and without profit to the society. From the report, it will be seen when Mr. Pedder's mission terminated, and in what manner it has been performed. The board of managers have instructed their publishing committee, to make special mention of the worth of their agent, and the very faithful manner in which he has executed the trust confided to him, not only as regards the able manner in which he has answered the inquiries set forth in the agreement under which he acted, but also in reference to his extraordinary economy in the expenditure of the funds placed in his hands for the purposes of his mission, purchases of seed, &c; and from the allowance of funds made to him after his

departure, (in consequence of the extension of his mission,) above the sums specified in the agreement; an example of economy worthy of imitation in the execution of like trusts. They also avail themselves of this method to testify to their fellow-citizens, their high sense of the obligations they consider themselves, and the country generally under to their agent, for the prompt and satisfactory manner in which he has performed his mission; and thus publicly return to him, collectively and individually, their thanks. From the necessity of Mr. Pedder's remaining longer in France than was originally contemplated, and from the time and labour consumed in preparing and publishing much matter relating to the subject, the society has incurred a considerable augmentation of expense. The managers have also felt it incumbent on them, to reward their intelligent, industrious, and economical agent, by a donation of money, over and above the sum first agreed upon; to all of which may be added the cost of importing and distributing the seed, and the publication of this pamphlet; the whole constituting an aggregate of no small amount, and which has fallen almost exclusively upon a few public spirited individuals. Under these circumstances, the managers, who entertained the hope of giving the report gratis to the public, find it necessary to make a small charge for each copy.

At the request of the society, Mr. Pedder has given them for publication, a few extracts from his diary, which contain important matter relating to beet-sugar making.

The making of "*salad oil*," from the seed of the poppy, has now become a source of revenue to the French agriculturist. The society recommend its culture and manufacture to the farmers and enterprising capitalists of America. For the purpose of affording information on this latter subject, extracts from Mr. Pedder's diary relating to it, will be found appended to this work.

JOS. S. LOVERING,
SAMUEL BRECK,
JACOB SNIDER, Jr.
} Publishing Committee.

Donations to the funds of the "Beet Sugar Society" will be received and acknowledged, if transmitted to either of the following named officers of the society.

JAS. RONALDSON, President,
JOHN VAUGHAN, Vice President.
JACOB SNIDER, Jr., Treas. & Sec.

MANAGERS.

Samuel Richards,	B. M. Hollinshead,
Nathan Dunn,	Jos. Sill,
Jos. D. Brown,	John Richardson,
Isaac S. Lloyd,	Jas. Wood,
Saml. Breck,	Fred. Brown,
Jos. S. Lovering,	Geo. Zantzinger.

REPORT.

TO JAMES RONALDSON, JOHN VAUGHAN, AND JACOB SNIDER, JUN., ESQS.

Philadelphia, August 6th, 1836.

GENTLEMEN,

On the 6th of February, I received your instructions to proceed to France, and examine into the present state of the culture of the beet and the manufacture of sugar therefrom, and I beg to lay before you a report of my proceedings in furtherance of the objects of my mission. I commenced my journey on the 8th February, landed at Liverpool on the 2d March, and passing through London, where I obtained letters of introduction to several persons of the first respectability in France, reached Calais on the 10th, and, on the same day, examined a very large manufactory of sugar in that neighbourhood.

On the 12th, at Bolougne, I delivered a letter of introduction from Dr. Bowring to Mons. Adam, the Mayor of the town, who furnished me with letters to three of the first manufacturers of sugar in the country, one of whom resided at Arras, the others at Valenciennes and Famars.

On the 13th, I reached Paris, and delivered letters to Mr. Nancrede; was engaged there until the 22d, when I left for Arras; arrived there on the 23d, and examined, on the same day, in company with a gentleman of that city, to whom I had brought letters, a sugar-house, constructed on the new principle of maceration, and was the next day introduced to Mr. C——, of Arras, by virtue of the letter of M. Adam. Here I remained until the 29th, when, finding that his process of crushing would be in operation for some weeks longer, I

took the opportunity of visiting Lille, Douay, Valenciennes, and neighbourhoods, to ascertain at which of those places it was, that loaf-sugar was made from the beet, by a first and single operation; as I had been repeatedly assured by many persons, even since my arrival in the sugar district, that it was so done, somewhere in the neighbourhood of those places; and that there too, sugar was manufactured without residuum or molasses; but ascertaining that the report was utterly unfounded, I lost no time in returning to the manufactory at Arras, where the proprietor has the character of being one of the first and most successful manufacturers in France. During this journey I visited many large and flourishing establishments, but found none so well conducted as Mr. C——'s, which determined me to remain and practice under him, that mode which had always kept its ground, through evil and through good report. Here, with other persons from various parts of the Continent, I met Professor Schubarth of Berlin, who, with Mr. Reish, had been deputed by the Prussian government, to examine into the mode practised in France, for the production of sugar from the beet, all of whom concurred in considering Mr. C——'s method the best they had examined. From these gentlemen I obtained data which I could scarcely have hoped to be furnished with, by any other means: and in company with them, I examined the operations of machinery, which had been patented for the purpose of expediting the process of evaporation by inclined planes, which was not found to be applicable to the business of making sugar, for very obvious reasons. From Professor S. I learned the fascination which is spreading over the whole Continent on the subject of beet sugar; he considers, that when well made, it is equal in every respect to that made from the cane, and that it can be manufactured to great profit, particularly in a national point of view.

At Arras I continued until the crushing season was ended, when I returned to Valenciennes, as I had heard that a large manufacturer whom I had before visited had purchased, for $10,000, a secret by which he was preparing sugar without molasses. This gentleman admitted that he had been offered the secret for the sum mentioned, but had declined it; proposing, however, to give the thing a fair trial;

he added, "but at the end of six weeks, I was making nothing *but* molasses." He believes that the person who claims to be the discoverer of this mode of working, has collected a large sum by way of subscription; but to prepare loaf sugar from the beet, by a first and single process, and to make sugar without molasses, he considers to be impossible, in the nature of things.

In that neighbourhood it is, that a small manufacturer (Jean Joseph Lecerf) has succeeded in preparing sugar on a *very small* scale. I found his residence, a tavern in the village of Onain, in the front parlour of which, he had, however, contrived to manufacture about half a ton of sugar by means of machinery the most simple imaginable. In the fire-place of this room he had fixed his deffi-cator, evaporator, and boiler; his wife's washing-tubs served for receivers and coolers, and a single sugar-pan was sufficient for the reception of his whole day's working. His rasp, the only tolerable instrument which he was possessed of, made four hundred revolutions in a minute, and was driven by two of his sons. In this way he actually made good sugar, but his knowledge not extending to the purifying process, much of it remains on his hands unsaleable. On my inquiring how long each process required before its completion, he replied, "I cannot say, for our operations were often completely stopped by the crowds which came to witness them, but we sold large quantities of beer and brandy by which I did well." And in truth, this seemed his strongest incentive to labour. The work is discontinued in consequence of the fear of the impost law, *but he absolutely made good sugar in a room* 14 *feet square.* I saw the medal which had been presented to him by the "Royal Central Society for the Encouragement of Agriculture," of which he is justly proud.

At Valenciennes, I again visited the large *refinery* for beet-sugar, capable of preparing two millions of pounds annually. The proprietor considers beet-sugar equal to cane-sugar, but even here, a considerable portion of molasses is obtained, the refiner observing, "If I did not procure the impurity in the shape of molasses, it must still remain in the sugar, to its great deterioration."

On my return from this journey I visited Cambray, famous for its sugar works as well as Cambrics, but in no place did I witness any process so applicable to our purpose as that practised at Arras. I

left France, and reached London on the 8th of June, took ship on the 18th, and arrived at New York on the 2d of August.

My numerous letters have made you acquainted with the state of things *as they arose*, but it would be impossible for me to do justice to the subject, were I to endeavour to detail the advantages which the cultivation of the sugar-beet has brought to France, and to the continent.

Over the whole country which I have visited, I have not seen a single acre of fallow, but thousands of acres of sugar-beet; the crops of all kinds clean as a garden and most luxuriant on kindly soils, giving employment to thousands of men, women, and children the whole year through, creating double rents and securing double crops in future years. The wheat straw of the farms, once used only as bedding for cattle, turned into the most nutritious and palatable food, by merely cutting it into chaff and steeping it in molasses and water for 24 hours; cattle, sheep and horses devour it voraciously, and upon this and the cake of the beet, after the juice has been expressed for the manufacture of sugar, both cattle and sheep are fattened in a very short space of time.

By means of my numerous and valuable letters of introduction, I have enjoyed advantages which no money could have purchased, and I trust I have profited by them. I have had opportunities of witnessing every part of the business relating to the culture of the beet, and the manufacture of sugar from the root; my *stranger friends* having communicated to me their valuable modes of proceeding, in the most kind and generous manner. The gentleman with whom I have spent so large a portion of my time, is erecting another establishment for the beet-sugar business, which will be the eighth in which he is engaged. From these he expects to produce three millions of pounds of sugar the next year; and on two farms near the town, he is cultivating 400 acres of beet this season. At his manufactory of animal carbon, he prepares that article for his extensive works, and to *this* establishment also, I have had access at all times, and the most unreserved communication with the manager of it. To Monsieur Crespel Delisse the country is mainly indebted for the continuance of the fabrication of sugar, as it had been all but abandoned; he and the Duke of Ragusa, (Marshal Marmont,) being almost the only persons determined to pursue it to

the end. For his perseverance and skill, he has obtained from his country a token of the order of merit, and is denominated "the Father of the beet-sugar manufacture of France." The uniform and very polite attentions which I have received from him, and every branch of his amiable family, I can never *repay*, but shall always *remember* with gratitude. Should you, gentlemen, think proper to adopt any part of the processes which I have witnessed, I beg leave to offer you my best services, and to assure you of my sincere and grateful respect.

JAMES PEDDER.

Here follow answers to the inquiries you did me the honour to entrust to me.

1st. The quality of land best suited to the growth of the beet?

Ans. A healthy subsoil is indispensable: after this, it is cultivated on almost any, of course, with various degrees of success. In the neighbourhood of Bolougne, the manufacture of sugar from the beet has been discontinued, *expressly* on account of the unsuitableness of the soil, which is chalk, with a very shallow depth of mould. Mons. C——. considers the soil of New Jersey (*a sandy soil, not apt to burn in the summer*) as very likely to be excellent for the purpose; the facility with which the crop might be taken up, and the advantages of obtaining the roots free from filth or clay, are valuable considerations; the latter, will conduce much to their preservation during winter.

2d. The mode of cultivation?

Ans. Plow the land in winter and lay it dry; obtain a pulverized surface before sowing, and drill the seed eight pounds per acre; hoe the land in the intervals of the rows (which might be twenty inches apart if the land is not very rich, or twenty-four inches,)—as soon as the plants have made tolerable progress; at the second hoeing, thin the plants in the rows to the distance of about fifteen inches, and the third hoeing may be performed with a horse-hoe.

3d. The best kinds of seed?

Ans. The white or Silesian, and the rose coloured, are the only kinds now sown in a large way; the yellow is still sown by a few, but to no great extent. Other kinds are said, not only to yield no sugar, but to be destructive to the process of crystallization, if mixed

or worked with them. The greatest care is taken to select the best roots for the production of seed, both as to their kinds and perfect formation; the largest roots are not the best for this purpose.

4th. The best time for sowing the seed?

Ans. As early as the season will admit, as the greatest advantage is derived from an early crushing, sometimes as much as 2 per cent. of sugar, besides the ease with which it is made to crystallize, the quality being also superior: the latter part of April, and all May is considered the proper season, but this might be extended to the first days of June.

5th. The proper time for taking up the crop?

Ans. For reasons just stated, the crop should be taken up as soon as the roots have completed their growth; the months of September and October the proper seasons.

6th. Manner of protecting the crops during winter?

Ans. Heat is as injurious to the roots as cold, as it induces fermentation, which is destructive of saccharine. The best preserved roots which I have seen, were deposited in long trenches, formed by throwing out the earth to the sides, and forming with it, sloping banks $2\frac{1}{2}$ feet in height; these trenches were ten feet wide, and about 100 feet long, in a dry soil, where the roots were packed without straw either at the bottom or sides, the tops of the heaps conical, and covered with a slight coat of straw, which was thickened during the severity of winter. But the almost universal practice is, to bury them in pits, dug in the fields where the roots are grown, 17 feet long, $2\frac{1}{2}$ feet deep, and 2 feet broad; each pit contains 3000 pounds of roots, is dug and the roots covered for 1 franc* per pit. This is by no means a good method; the throwing out of the earth mixes a great quantity of the sterile subsoil with the enriched upper stratum, and removing the roots during winter is the cause of much injury done to the soil, by the cutting in of wheels in wet weather; it prevents also the proper cultivation of the land, by ploughing to lay dry.

7th. The manufacture of sugar in all its processes?

Ans. The manufacture of sugar consists of seven distinct processes.

1st. Washing or scraping the roots.

* Twenty cents.

2d. Rasping or crushing the roots, but *not by cylinders.*
3d. Pressing the pulp by hydraulic presses.
4th. Deffication.
5th. Evaporation.
6th. Clarification.
7th. Concentration.

1.—*Cleaning the Roots.*

In many large factories this is done by washing in long wooden cylinders, with open sides, which revolve by the power of steam in cisterns of water: the roots are thrown in at one end of this cylinder and are carried round and ejected at the other by a spiral or Archimedes' screw; and if the work could be effectually performed by these means, it would be a great saving of expense, but the the fact is, it is at best a most inefficient mode. If the roots have been grown on a stiff soil, quantities of earth will still be found adhering to them, maugre all your attempts to free them from it. This will do great injury to the teeth of the rasp while crushing, and will, I presume, be of no value in the cake as food for sheep or cattle. The large roots are often found to be hollow and partially decayed at the crown; this putrid matter being acetous, is peculiarly destructive to the yield of saccharine, and no washing will remove it. The end of the tap root and the lateral fibres are almost useless to the production of sugar—often very injurious; I therefore prefer to clean by scraping with a knife, when the earth and decayed parts are easily removed: the cuttings are greedily devoured by cattle and hogs, and that portion only of the root is used which is best calculated to yield a superior quality of sugar.

2.—*Crushing or rasping the Roots.*

In no manufactory, except where maceration is practised, is this process performed by any other means than by the rasp. This is a wooden barrel, set transversely with steel saws at half an inch apart. It is $13\frac{1}{2}$ inches wide, and 23 inches diameter, and when propelled by steam, makes about 900 revolutions in a minute, crushing into impalpable pulp, 90 pounds of roots in that space of time. Pressing by cylinders has often been tried, but found to be totally inapplicable to the purpose.

3.—*Pressing the Pulp.*

The heat engendered by the process of rasping brings on instantaneous fermentation, which is destructive to the yield of sugar: no time is therefore lost in submitting the pulp to the action of the press, by which the juice is extracted in a surprisingly short space of time. In no instance did I witness this operation performed by any but hydraulic* pressure, the power of which is astonishingly great. The machine for this purpose is very expensive, but when obtained, the saving of labour and time is great. The pulp falls from the rasp into a square box below, from whence it is taken in a deep *wooden* or *copper* shovel, and put into a bag which is held open for its reception; it is then placed upon a frame of wicker work, standing upon a small hand-barrow resting upon wheels, where it is spread evenly in the bag, and the mouth is then turned down to prevent the escape of the pulp while under the press; it is then covered by another wicker frame and another bag, until the pile consists of thirty-five bags and wicker frames. The whole is then removed to the press, where a man takes and deposites them on the wooden platform, which sets on the bed of the press, and the pressure is then applied. So soon as the juice is extracted, the pressure is taken off, the bags are emptied of the dry cakes, and the press is ready for another load. These presses are always worked in pairs, so that while one is pressing, the other is being loaded. The juice flows from the press into a cistern beneath the floor, from whence it is immediately pumped into the defficating pan, which is placed so high, that the contents might flow from it by a pipe, into the evaporator.

4.—*Defication.*

The defficator is a copper pan, into which the juice is pumped, so as to fill it within four inches of the top, when heat is applied, either by means of steam or fire. As soon as the juice has attained the heat of 58° Reaumur (162½° Fahrenheit) lime is added in exact proportion to the acid contained in it, which is ascertained by chemical tests. This lime is prepared by slaking with *hot* water and mixing,

* The great variety of power presses to be obtained in this country, at comparatively small cost, will obviate the necessity of always using the hydraulic press.—*Pub. Com.*

so as to be of the consistence of cream, and when it is added, the greatest care is taken to mix it most intimately with the juice, by stirring with a wooden spatula: after this, it is suffered to rest, and the heat is raised to the boiling point, when it is suddenly checked by withdrawing the steam or fire; as soon as the juice has become perfectly clear, it is run off into the first evaporator, taking care that none of the scum, or sediment at the bottom of the pan passes with it. The scum and sediment is then collected, put into bags and pressed, to obtain all the juice it contains; after which, the residuum is thrown to the dunghill, a valuable manure.

5.—*Evaporation.*

The evaporator is a copper pan, into which the clear defficated liquor flows, until the pan is about a third part full; to this, a small quantity of animal charcoal is added, and the fire or steam is applied; here it is boiled until it marks 21° by the saccharometer, when it is passed into a receiver, from whence it flows into the clarifiers for purification. During the boiling, if the juice rises in the pan so as to threaten to overflow, a small quantity of tallow is added, which causes an immediate subsidence, and facilitates evaporation.

6.—*Clarifying.*

The clarifiers are wooden or copper pans, 2 feet 8 inches deep, 20 inches diameter at top, 11 inches diameter at bottom, each with a small brass cock near the bottom. A copper strainer standing on three feet and covered with canvass, is placed in the bottom of each clarifier, which is then filled with granulated animal charcoal, (about 100 lbs. in each pan,) and is covered with another copper strainer and cloth, and then the sirop is permitted to flow upon it until the pan is full. After it has stood some time, the cock is opened, the sirop is permitted to flow slowly into a cistern, and the pans are refilled as fast as they empty. From the cistern the sirop is pumped into the condenser, for a last evaporation. These clarifiers are emptied of their animal carbon twice in the day, and filled with other, fresh burnt from the kilns. It is found that some of the saccharine remains in this carbon, it is therefore put up to receive the juice from the defficator as it passes into the first evaporator, by which means the saccharine is extracted; after which, the animal

carbon is turned out to be washed preparatory to another calcination, whereby it is rendered fit for farther use, *ad-infinitum.*

7.—*Concentration.*

The clarified sirop is evaporated in the condenser to 41°, (by saccharometer,) at which point it indicates signs of fitness for crystalization, which may be known by the usual test; drawing between the finger and thumb, when if the thread break and the end draws up to the finger in a kind of horny substance, it is enough.—Another mode is, to blow through the holes of the skimmer, when if the sirop be sufficiently tenacious to form air bubbles and fall to the ground, and on bursting leave a white substance, it is immediately removed from the fire.

At the commencement of the crushing season, and when the roots are fresh and good, four pounds of lime will be found sufficient for the deffication of $8\frac{1}{2}$ hectolitres,* (225 gallons,) but as the season advances, more lime will be required, until at length, at the conclusion of the season, and when vegetation has commenced, as much as 7, and even 8 lbs., have been found necessary to effect the purpose; in this case there is danger of an excess of lime, which is taken up by means of acid, applied at the time of condensing the sirop for the last time. Sulphuric acid, reduced by water in the proportion of 44 water to 1 of acid, is used for this purpose, the exact quantity necessary must be judged of by chemical test; if more is used than is proper to neutralize the lime, the refiners of the sugar object to purchase, as it subjects them to much inconvenience, and some loss; practice, however, soon makes perfect this part of the business. When the concentration has been carried to the crystallizing point, the sirop is poured into large copper pans, which are placed in the air, where it remains about two hours, to cool, during this time it is stirred occasionally, that the cooling might go on regularly; it is then poured into flat pans made of tinned iron, 2 feet 3 inches long, 15 inches wide, and $3\frac{1}{2}$ inches deep, and is then left to crystallize, in a cool atmosphere, for 12 hours and something more. These pans are then removed to the stove, and set on their ends that the molasses might drain from them, and in 12 days from

* The hectolitre is 105 6-10 quarts.

the making, the sugar is fit for the market. On removing the sugar from these pans, about one-tenth of the contents is found at the bottom edges to contain molasses, and must be separated from the cake, this is mixed with the molasses which has drained from the pans, is reduced to 17°, (by saccharometer,) with water, evaporated to 21°, and is again submitted to the clarifying process; after which it is concentrated to 41°, (by saccharometer,) for the purpose of making sugar of second quality, which, if well done, is equal in value, for the purpose of refining, to sugar of first quality. When this sirop of second quality is sufficiently concentrated for crystallizing, it is poured into the coolers, and from them removed to cone-shaped earthen pans, and placed, first in the cool, and afterwards removed to the stove; at the end of about 24 hours the stoppers are removed from these pans, and the molasses permitted to flow away, and in about six weeks from this time, the sugar from these pans is fit for the market. On removing these loaves from the pans, a portion near the holes will be found to contain a considerable portion of molasses mixed with sugar; these portions are collected and reduced by water to 17°, (by saccharometer,) and boiled to 21°, when the sirop is passed through the clarifying pans, and concentrated for crystallizing, as above. During the boiling to 21°, large quantities of scum will arise, which must be carefully removed: this scum is to be washed with water, to obtain from it all the saccharine, and this water is then used to reduce the impure sugar, from the pans, so that nothing be lost. From the molasses of these pans of second quality sugar, there may be extracted sugar of third quality, but the labour and expense of fuel for evaporation, together with the great length of time which it requires to perfect crystallization, sometimes a whole year, I am convinced it will be, in this country, far more profitable to obtain the result in the *shape* of *beef and mutton*, than in sugar.

8th. Yield of sugar per acre and cost of manufacture, independent of the expense of cultivating the crop?

Ans. Much contrariety of opinion exists upon this subject. Under favourable circumstances, I have reason to know that $8\frac{1}{2}$ per cent. of sugar has been obtained. This consists of 1st, 2d, and 3d qualities, and leaves only the molasses, which cannot be crystallized

by any process now known. This is the maximum; the minimum may by known by examining the account published in an appeal against the proposed tax on indigenous sugar in France, where 4 per cent. is assumed as the minimum; at a yield of 5 per cent., a profit is there shown to arise from the fabrication, taking the 1st and 2d qualities sugars only into account; to this then must be added the value of the 3d quality sugar, the molasses, the cake for feeding cattle and sheep, and the value of the manure arising therefrom. Say only then, that all above the yield of 5 per cent. is profit in the shape of sugar, to which add as above, and a judgment may easily be formed. I know that the yield of this unproductive season (in consequence of the severity of the winter) has been 7 and $7\frac{1}{2}$ per cent. of sugar, where the processes have been conducted by means of steam to the extent of, perhaps 120 horses power; but then it is but fair to admit that, with such facilities, the whole of the saccharine has been extracted, *still it has been done.* Taking, therefore, 6 per cent. as the medium, the yield per acre might thus be stated, the average crop of roots being 40,000 pounds per acre.

Sugar, 1st and 2d quality,		2400 lbs.
Molasses,	2 per cent.	800 lbs.
Cakes,	15 do.	6000 lbs.
		9200 lbs. per acre.

In the estimate of *the cost of the manufacture of sugar*, the profit upon the beet culture must be made to appear, as also, the profit arising from the feeding of cattle and sheep, with the molasses and cakes, and the value of the manure. To this add the profit arising from the preparation of animal carbon, which every extensive manufacturer prepares for his own use, and the value of the seed, which all such are enabled to send to market, and I estimate the cost of sugar to the manufacturer at 4 4-7 sous ($4\frac{1}{4}$ cents) per pound. Professor Schubarth was convinced of the correctness of this estimate, and formed his data upon it.

9th. Mode of expending the refuse of the sugar house for the fattening of cattle?

Ans. The cakes are preserved in magazines sunk in the ground, where they are beaten hard and left to ferment. At the end of six or nine months they are cut out in a vinous state and given to cattle and sheep; excellent for the purpose. A sheep will eat 5 pounds of this food mixed with a small quantity of oil cake, say about 2 pounds for 10 sheep a day. Cattle, while fatting, eat 75 pounds of beet cake and 6 pounds of oil cake per day. The molasses is mixed with water and poured upon chopped straw in cisterns, where it remains for 24 hours, when it is given to horses, cattle, and sheep, who devour it voraciously. The sheep pens are strewed with lime instead of straw, a most excellent mode, as it saves straw which might be cut into chaff, conduces to the health of sheep, as well as to their cleanliness. The lime prevents and cures the foot-rot, and is the means of raising a large quantity of most valuable compost, which is applied as a spring dressing to young clovers; the effect is instantaneous. Sheep fatten in 2 months, or 60 days. The cakes from 100 pounds of beet, with a mixture of molasses and straw, sufficient food for three sheep per day. From 2000 pounds of beet, food for 60 sheep for 1 day; from 1 acre of beet, therefore, food for 60 sheep for 20 days; the cakes from 3 acres of beet, with an allowance of straw and molasses, and the above quantity of oil cake, sufficient to fatten 60 sheep for the market.

10th. What kind of cattle, and at what age are they preferred, so as to give the greatest profit for fattening, and the usual time of feeding.

Ans. Oxen are not put to fatten until five years old, they are worked on the farms until that age. Cows fatten well, and all descriptions of cattle are fed in as short a time as upon other customary food.

11th. To examine and make drawings of buildings, &c.

Ans. This I have done, and am prepared to superintend the construction of such as might be required.

12th. To procure a quantity of the best beet seed for immediate sowing, and samples of sugar, &c.

Ans. The sugar which was forwarded, together with the beet seed, was obtained from a refinery at Paris. The samples of unrefined sugar which were delivered, are *bona fide* from the beet, and

were procured from the different manufactories which I have visited, and show the various qualities and sorts distinctly.

13th. What crop precedes the beet, and what is the estimated quantity?

Ans. In many places beet is grown every second year, a crop of grain intervening; in some places every year in succession; a field in the neighbourhood of Arras, has borne beet, either as a crop for crushing or for seed, for the last 15 years. It is sown after every crop, but does best perhaps, after clover, the land ploughed in winter and got ready for an early spring sowing. Oats often precede the beet, but in this case it is usual to manure for the beet, the manure buried in drills after the English method. (See answer to question 17.)

14th. What crop succeeds it, &c.?

Ans. Too often wheat, a bad practice. The land should be laid dry for the winter and sown with a spring crop, clover always accompanying it. Such crops excellent; wheat light and small eared, apt to blight, quantity often not more than 18 or 20 bushels per acre.

15th. Is the crop ever manured for?

Ans. Yes, after oats, for it is found that manure is not, of *necessity* injurious to the crop of sugar, as it was once thought to be.

16th. What kind of manure is used, and what effect are different manures supposed to have (if different are used) on the saccharine?

Ans. An abundant supply is always found in the farm yard, for as the beet is sown as a fallow crop, generally without dung, it throws the usual time for manuring one year back, *an incalculable assistance to the dung heap.* The refuse of the sugar house is reserved as a top dressing to the clovers; bones are too valuable to be used as manure, as they are required for clarifying the sugar: lime not in use, except for strewing the floors of the sheep sheds, where it becomes one of the richest and most valuable manures known.

Mem. Sheep confined to sheds and bedded with straw, soon contract the disease called the foot-rot, which is occasioned by the heat and moisture arising from filth, which is prevented by the use of lime.

17th. What is the weight of the average crop of beet and grain?

Ans. Under favourable circumstances and seasons, beet 40,000 pounds per acre, oats and barley 35 to 40 bushels, wheat 25 to 30 or 33 bushels per acre.

18th. Are crops most productive of saccharine on sandy soil, or loam?

Ans. Light soils are preferred, if they are not of a burning nature. Moisture is necessary to the growth of the beet, but if they are raised on land with a wet subsoil, they will rot in the winter, although they might appear, at the time of taking up, to be perfectly sound. Deep soils produce large crops, but they are not valued on that account, the small roots often producing more sugar than large ones. No judgment can be formed but by experiment. The land about Douay is lighter than at Arras. In that part of the country, 52,000 pounds per acre of beet is not considered more than an average crop.

19th. What is the rotation of crops?

Ans. Beet, beet, beet. Beet, wheat, beet. Oats, beet, barley with seeds.

20th. What is the price of the best beef, fed from the beet of a sugar house, when compared with beef otherwise fed?

Ans. Equal, as cattle are never finished with beet cakes alone, an allowance of oil cake does the business quicker.

21st. How does the use of the refuse of the sugar house affect the produce of the dairy?

Ans. Good for all kinds of cattle. Cows which give milk, must not be fed with fermented cakes, as they communicate an unpleasant flavour to the butter. Molasses when mixed with water and poured on cut straw or hay, and left for 24 hours, is excellent for the purpose.

22d. What are the expenses of conducting a beet sugar manufactory, and what the estimated profits?

Ans. *The raising of the beet* and the *manufacturing of the sugar*, should always accompany each other, and an estimate made of both united, would show the result. If the beet is grown, and sold to the sugar maker, the land is robbed of the manure arising from the expenditure of the crop, and although great profits might arise at first from this system, it must in the end prove ruinous: and if the

sugar maker has to purchase his roots for crushing, he often meets with those which yield but little sugar; he sells the cakes and molasses to those who get his profit upon feeding, and his manure, from the sugar house, for less than a quarter part of its value. I have scarcely met with any one who is contented with his share, if divided, although there are many who are compelled so to act; the perfection of the beet root culture in France is, when it is joined to the making of sugar.

In the town of Arras, a person has established a sugar house upon a very economical scale, performing much of the labour and superintendence in person, he erected most of the machinery with his own hands, and is a very intelligent man. He rents land, properly prepared, of the farmers in the neighbourhood, for the growth of his crops of beet, at the charge of from 200 to 230 francs per acre; he has no means of feeding sheep with the cakes, and the molasses and manure he sells to those who are making a profit from this branch of his business; it must be a good trade which could bear such weeding; and yet hemade 110,000 pounds of sugar last season.

Cost of establishing his Sugar House.

Horse wheel, rasp and requisite machinery	2.200 francs.
2 Hydraulic presses, pumps, &c. complete	4.000
2 Defficating pans, 4 feet 4 inches long, 3 feet 5 inches wide, 16 1-2 inches deep	2.400
2 Concentrating pans, 4 feet 7 inches diameter, 16 inches deep	900

Estimated cost of the establishment with necessary utensils, pumps, cisterns, clarifiers, clais, bags, pots, pans, skimmers, &c. about 26,000 francs, ($5,200.) This apparatus, sufficient to employ 30 men and women by day only; the preparation of sugar for the season, say from the 10th September to the 15th April, about 110,000 pounds.

At this establishment, no part of the processes are conducted by means of steam, the expenses are therefore heavy; to arrive at the *real cost* of manufacturing sugar here, would be to a stranger, difficult, for obvious reasons; look to question 8.

Price of new copper utensils in France, 38 cents per pound.

23d. Rent of land and price of labour?

Ans. Land may be rented in the country at 40 francs per acre, ($8) but all such is not fit for the growth of beet; labourers receive only 15 cents per day, but their work is proportionably slowly performed.

24th. How much land does the drill sow per day?

Ans. In the spring, and at the season when great exertion is necessary, a man takes a horse and commences sowing at 4 o'clock in the morning, continuing until8; he is then relieved by a second man and horse, who sow until 12, when the first man and horse return, and take his place until 4 o'clock, at which time the second man and horse come on, and continue until 8 in the evening. In these 16 hours, 19 French half hectares* are sown, harrowed, and rolled by two men and two horses; but it is usual at these busy seasons, to allow a boy to drive, who might ride the horse and guide at the same time. This drill sows with equal regularity all kinds of seed, from the poppy to the horse bean.

25th. Estimate of the cost of raising a crop of beet?

Ans. M. Crespel's Bailiff's account of the expense is as follows per acre, or half hectare.

Rent 40 francs, 2 ploughings 16 francs, taxes 6 francs,	62
Harrowing 2 francs, rolling 1 frank, drilling ½ franc,	3.10
3 hoeings 12 francs, taking up and topping 14 francs, seed 8 francs,	34
Digging pits, burying roots, and filling	10
Francs	109.10

Estimate from the "Question Impot."

Rent of land 36 francs, taxes 6 francs,	42
Ploughing, &c. 15 francs, seed 8 francs, and sowing ,10 $\frac{10}{100}$	23.10
Weeding 11 francs, taking up, &c. 21 francs,	32
Francs	97.10

* Half hectare 5,980 square yards, or about 1 1-3 acres.

Monsieur H. Billet's estimate.

Rent of land, prepared by the owner	200 or 230 francs.
Cleaning crop 4 times	14
Taking up and topping the roots	14
Burying the roots 10 francs, seed 8 francs	18
Francs	246

Mem. The succeeding crop should be debited with a portion of the expense of hoeing, but this is lost to those who rent land of the farmer; he it is who reaps the advantage.

Monsieur Guffroy's estimate.

Owns land, but hires to plough, clean the crop, take up and bury in pits, &c.

Rent and taxes per acre	46 francs.
Ploughing, &c.	25
Weeding crop 12 francs, seed 8 francs,	20
Taking up, burying, &c.	19
Francs	110*

Recapitulation.

Monsieur Crespel has land, and farms by means of his own.
Monsieur Billet has no land, hires land and labour.
Monsieur Guffroy has land, but hires labour.
Estimate from the "Question Impot."

From these four distinct sources of information, a pretty correct estimate of the expense of cultivation may be drawn.

Value of an average crop of beet, 40,000 lbs. at 1 fr. per 100 lbs. - - - - -	400 fr.
Cost of raising the crop, - - -	110
Profit -	290

* See Monsieur C.'s Bailiff's account.

The value of the leaves and cuttings of the roots, at the time of taking up the crop, about 10 fr. per acre; say then, the profit per acre is 300 fr. on cultivation alone.

26th. To ascertain the cost of machinery or apparatus used in the culture of the beet and the manufacture of sugar.

Ans. The cost of Mons. B.'s machinery and apparatus may be seen under the 22d question, but much of this was erected under his immediate inspection, and by his own hands: he intends to add to it a generator of 12 or 14 horse power, by which he will be enabled to perform the last operation, or concentration, by means of steam; this will not only save time, but expense; the sugar will be of better quality, and command a higher price in the market: with this force of steam he may possibly be able to defficate his juice, as well as to concentrate his sirop, which will be a great advantage. He calculates that this addition to his machinery might be made for about 8000 francs. The whole of the machinery and apparatus belonging to Mons. Lecerf at Onain, near Valenciennes, did not cost the proprietor more, perhaps, than 500 francs! His rasp, the only tolerable instrument he was possessed of, might have been worth 180 of this sum; all his other instruments were old and very mean, and yet he made good sugar, although it could not be to much profit.

A manufactory near A. is being fitted up with machinery, upon a rather small scale, where all the processes, except deffication and concentration, will be performed over naked fires, without the aid of steam. The rasps will be propelled by 6 oxen, a power sufficient to drive 2 rasps, and work the hydraulic presses, crushing about 60,000 lbs. of roots in 24 hours. By these arrangements, the proprietor expects to save, in the cost of investment, about one-half the expense of a large steam apparatus.

At a large sugar-work near A., established at an expense of about £12,000 stg. has been introduced the new mode of working upon the principle of maceration, which has proved a failure; here, by means of all this machinery, they prepared but 200,000 lbs. of sugar the last season. The refining business attached to this establishment has been relinquished, in consequence of its having been found to be perfectly incompatible with the *making* of sugar: and this has been the case with many other establishments in that part of the country.

At Mons. Pera's mill, in A., for making Poppy Oil, the best by far in that *Oil District*, the machinery is driven by a steam engine of 9 horse power; the whole most perfect. The cost of the apparatus and building was £4,000 sterling.

The drill, made by Mons. C., is universally approved of; it has ten wheels, forming two sets, so that when beet-seed is drilled, at double distance between the rows, the set of three wheels is used, which operate as rollers upon the seed dropt from the box; but when the drill is set for 5 rows, as for wheat, the set of 5 wheels is used, performing in the same manner: the price complete 400 francs.

A barrow-hoe has been invented for the purpose of cleaning between the rows of plants, it is simple and of easy construction, and is used by pushing forward; a man hoes with it about an acre and a half a day, the work not laborious, if the land has been well cultivated. Another hoe, on a different construction, and of greater power, is used by the same means; but to this might be attached a small horse, which would render it a most convenient and effective instrument, particularly well adapted to the purpose of row-culture; its construction cheap and simple.

The French hand-hoe is superior to all others; it is in general use for almost all purposes; having a long and crooked neck, the weeds rise and pass over, forming no impediment to its progress; only requires to be known to be approved. Price 38 cents each.

The spade in general use has a long straight handle, the steel part hollowed like the clay-spades of London, proper for taking up beet-roots, which are never plowed up, lest they should be wounded by the share; an injury of this nature is ruinous to the yield of sugar, as it brings on fermentation of the acetous kind. This spade is particularly useful in clay soils, as it is worked with ease, by reason of its peculiar form and straight handle.

All kinds of machinery of magnitude are more expensive in France than in England; a high duty on the materials of which they are constructed, is the cause.

Labour is much cheaper in France than in America; but perhaps this is no advantage in a national point of view; the workmen being unable, from the low rate of wages they receive, to obtain little besides bread to eat, and but little clothing of any kind, are not equal to the labour performed by those who are better fed; but they seem contented with their lot, and have never known better fare.

COPY OF AN AGREEMENT,

Entered into, for the introduction into this country, of such information as can be obtained in Europe, relative to the manufacture of *Sugar* from the *Beet.*

Philadelphia, February 6, 1836.

The following Articles of agreement are this day entered into between James Ronaldson, John Vaughan, and Jacob Snider, jr. of Philadelphia, for themselves and others on the one part, and James Pedder, of Philadelphia, on the other part. The aforesaid parties hereby binding themselves, their heirs, executors, &c. for the faithful performance of their several parts of this agreement, the conditions of which are as follows:—viz. James Pedder is to embark for England and France, (and Belgium if requisite) as soon after the execution of these articles as may be, not delaying the same beyond the 20th inst., unless prevented by sickness or other unforeseen circumstances; and on his arrival in Europe, to proceed without unnecessary delay to procure as full and satisfactory answers as he can, to the following inquiries, and all other information that is to be obtained relative to the culture or application of the vegetable known in France as the *Sugar Beet;* the process or processes of manufacturing Sugar from the same, and the process or processes of evaporation, crystallization and refining of Sugar manufactured from the Beet; and all and every other information in any wise pertaining to the aforesaid vegetable.

1st. The quality of the land best suited to the growth of the Beet.
2d. The mode of cultivation.
3d. The best kind of seed.
4th. The time of sowing the seed.
5th. The proper time for taking up the crop.
6th. The manner of housing it, &c.
7th. The manufacture of the Sugar in all its processes.

8th. The yield per acre, its costs, &c., independent of the expense of the culture of the Beet.

9th. The mode of expending the refuse of the Sugar-house for the fattening of cattle.

10. What kind of cattle, and at what age are they preferred, so as to give the greatest profit for fattening; and the usual time of feeding.

11th. To examine, and to make drawings of the necessary buildings and apparatus relating to the manufacture of the Sugar, and of any improved implements which may be in use, either for the cultivation of the crop or the manufacture of Sugar, and to ascertain the cost of the same.

12. To procure a quantity of the best Beet seed for immediate sowing, as also, a quantity of such variety as can be had of the Sugar manufactured from the Beet, and transmit the same to this country as soon after his arrival in France as is practicable.

13th. What crop precedes the Beet, and what is the estimated quantity?

14th. What crop succeeds it, &c.?

15th. Is the crop manured for, and how?

16th. What kind of manure is used, and what effect are different manures supposed to have (if different are used) on the saccharine?

17th. What is the weight of the average crop of Beet and Grain?

18th. Are crops most productive of saccharine on sandy soil or loam?

19th. What is the rotation of crops?

20th. What is the price of the best beef fed from the Beet, or Sugar-house, when compared with beef otherwise fed?

21st. How does the use of the refuse of the Sugar-house affect the produce of the dairy?

22d. What are the expenses of conducting a Beet Sugar manufactory, and what are the estimated profits?

23d. To ascertain the cost in Europe of any machinery or apparatus used in the culture of the Beet or manufacture of the Sugar.

For and in consideration of the faithful performance of the foregoing duties, the first named parties to this agreement, James Ronaldson, John Vaughan, and Jacob Snider, jr., for themselves

and others as aforesaid, hereby agree to pay all and every necessary expense which the said James Pedder may be put to, in the prosecution of his journey for obtaining the answers and information on the above named subjects and inquiries, and also to pay him as a remuneration for his services, the sum of three hundred dollars, under his order in such manner as he may direct. *Provided* always, That should the said James Pedder remain in Europe longer than is deemed requisite by the said James Ronaldson, John Vaughan and Jacob Snider, jr., for the purposes mentioned herein, that the said James Pedder shall have no claim on the said James Ronaldson, John Vaughan and Jacob Snider, jr. for any sum of money to be paid for his expenses of said journey, beyond the sum of six hundred dollars, exclusive of the aforenamed sum of three hundred dollars to be paid him for his services.

In Witness whereof, the several parties have hereunto set their hands and seals, the date before written.

JAMES PEDDER. L. S.

JAMES RONALDSON. L. S.
JOHN VAUGHAN. L. S.
JACOB SNIDER, Jr. L. S.
For themselves and others, contributors to the expenses of the undertaking.

Signed, sealed and delivered in the presence of
Chas. O'Hara, Joseph Mogridge, Geo. K. Tryon.

MISCELLANEOUS REMARKS AND MEMORANDA.

March 10, 1836.—Visited sugar house at Brasville; fifty persons employed—crushing mill propelled by wheel, in which five oxen and a boy with a whip were incessantly engaged: roots of beet well kept through this unprecedentally severe winter; cleaned by scraping, not washing. Oxen of fifty score fatting upon the cakes of the beet, mixed with a little oil cake—fine breed of cattle. About 300 sheep of the merino breed confined to open sheds, fatting upon cake, in excellent condition: sheds bedded with straw, very wet and filthy. Troughs for feeding sheep placed on both sides the sheds, and a small rack over, for hay, when requisite; both cattle and sheep fed with cake as it comes from the press. No land for growing beet attached to this manufactory; purchased of the neighbouring farmers at 10 francs per 1000 lbs.—well supplied; situated on the banks of a canal; 40 barges loaded with beets have been seen at one time, waiting for their turn to unload. Brown sugar only made at these works: at Lisle is a *refinery* for beet sugar.

Extract from French Paper.—"The exertions making in France and throughout Germany to simplify the process of preparing sugar from the beet, are numerous and increasing. At the recent meeting of German naturalists at Boun, the section of agriculture and rural economy was almost entirely occupied with papers and discussions on the subject."

March 17.—A person at B—— went there so poor as not to be able to purchase milk for his family; he commenced the beet sugar business, and is now worth £6000 sterling a year.

March 22.—Accompanied Mons. F. to examine the large sugar works at T——, conducted on the principle of maceration by hot water; the pulp, or cake, wheeled away to the dunghill, not fit food for cattle: horses, cattle, sheep and pigs feeding on cakes at a neighbouring manufactory, the produce of the dry pressure, which many have re-adopted. Chaff cut here for farm horses, one sheaf wheat straw, one of tare and oat hay, one of rye in the straw, and one of hay: this, mixed with molasses and water. The cakes, for pigs, must be boiled.

March 24.—Introduced to Mons. C. Here I met Professor S. and his draughtsman, sent out by the Prussian government; a remarkable circumstance, as it was in Prussia that sugar-making from beet was first practised: the professor is quite satisfied with what he has witnessed. Works here conducted by a power of steam of 120 horses! In Siberia the beet produces 12 per cent. of saccharine!—so informed by Professor S.

March 25.—These are the advantages of crushing early in the season: four pounds of lime sufficient for defficating a quantity of juice, which, at the end of the season, would require eight or even ten pounds. Saccharine has decreased in proportion to the increased quantity of lime required: crystallization now easily performed; sugar of superior quality.

March 26.—Two hundred and fifty bushels of coal burnt in twenty-four hours. Seventy-four men and women employed during the day—64 during the night: 2,003,000 lbs. sugar manufactured last year—expects to make 3,000,000 lbs. next year; "cost to manufacture $4\frac{4}{7}$ sous per pound: this covers every expense—buildings, machinery, repairs, fuel, interest of capital invested, &c."—*Professor S.'s Communication.*

March 27.—Visited, in company with the professor and others, the fabric at B——, constructed on the new principle of evaporation by inclined plane: the machine about seven feet long, two feet three inches wide, with edges turned up about three inches; the bottom formed of copper and ribbed, like the washing boards of America, made so to continue the juice longer in the times of passing. The defficated juice was made to flow over this unequal surface, forming an inclined plane, the elevation or depression of which was regulated by means of wedges. The specific gravity of the juice, when let on, was 4° by saccharometer, and in one minute, the time which it was in passing, it tested 35°! The consequence was, a part of it had grown so *glutinous* that it adhered to the bottom of the machine, and would not flow; the amount of juice was therefore increased, with the extremest care, but in consequence of having to make its way over that portion which had become fixed, it came off so low as 15°, 12°, 9°, and even 6°! without the workmen having the power to regulate it; on some parts of the incline, the juice was burning, while other parts were sending it down scarcely at all evaporated;

thus requiring the constant application of a scraper, to keep it regularly spread during its descent, and, but for the constant application of butter, also, it would not have been possible to make it flow at all—a total failure—although the inventor has patented it, and charges 1000 francs for an incline, and 1000 francs more for the liberty of using it. On leaving this work I said to Professor S. "*to be?*" he replied, "*not to be.*"

March 29.—At Valenciennes, saw Mr. T.'s manufactory—he is a farmer, brewer, wine-merchant, distiller and sugar-maker; has the character of being an excellent manager in all: employs one rasp and three hydraulic presses; cleans his roots by scraping, crushes 50,000 lbs. in 24 hours, and employs 50 work people. At the conclusion of the day's work, and before the people come on for the night, every part of the apparatus is cleaned and sprinkled with lime water—an excellent practice, stops fermentation. Purchases roots at 10 francs per 1000 lbs. and sells the cakes for 5 cents per basket, about half a bushel; price of first quality sugar 68 francs per 100 lbs.; smiles at the idea of running the beet juice into refined sugar by first and single process, or making sugar without molasses. Introduced to Monsieur Charpentier, professor of chemistry, who assures me these things have never been done; considers the present mode of working all sufficient; land lately worth 500 francs will now bring 1200 francs. Visited Monsieur B.'s refinery for beet sugar; pipes for conveying sirops, pumps, &c. made of zinc, evaporates by steam, and prepares 2 millions of pounds annually. Three years ago, 13 beet sugar manufactories near Valenciennes, now there are 64, and many others erecting.

March 30.—At Famars, Monsieur B.'s manufactory; no part of the processes conducted by steam. His defficators are hung like scales, one of which is over the fire, while the other is being filled with juice from the press, preparatory to deffication; when the first comes to the boil, it is turned off the fire, the very act of which brings the other on; evaporates to 15° only, the first time, and passes through animal carbon; then evaporates to 27° and clarifies again, and then condenses to 44°. To wash sugar in pans, uses white sirop at 33°; if higher specific gravity it would not flow, if lower, it would carry with it a portion of sugar; repeats the washing three times to procure *white sugar*, about a pint and a half of sirop

sufficient to wash a large pan of sugar each time. The rasp makes 700 revolutions in a minute, is driven by oxen, six of which do this and work the hydraulic pumps; crushes 54,000 lbs. of roots in 24 hours; 100 lbs. of beets will give 6 lbs. white sugar of first quality, and 4 lbs. sirop and molasses; thinks the manufacturing of sugar only in its infancy, does not consider six months sufficient time for a person to acquire the necessary information. Bones which lately sold at 2 francs, now worth 8; revives his *carbon ad infinitum.*

March 29.—Dined at Monsieur C.'s 5 Prussians and Germans in company. A Monsieur J. from Potsdam, a sugar refiner, on his tour through France and England for experience in his business; is satisfied of the impossibility of refining from the juice by first process; was here 6 months last year, to learn of Mr. C. the art of sugar making, returned, and established his son, who made 70,000 lbs. the first winter. Mutton on the table fed with beet cakes; all kinds of sweet cakes and confectionary in every variety of shape, prepared with beet sugar. Received most kindly by Monsieur C. who expressed a desire to forward our views in every way in his power, offering to instruct me in the business of sugar making as practised at his manufactory.

March 30*th.*—At Mons. H.'s manufactory—one of the noblest I have seen; crushes 75,000 lbs. of roots in 24 hours, steam-engine 10-horse power; steam for evaporation 80-horse power; makes no white sugar; mixes first and second quality, and sells to refiners at 75 francs per 100 lbs. Does not require acid in any of his operations, prefers to pass the sirop a third time through the clarifier; cleans roots by scraping in preference to washing: defficates at 74°* R. Saw 30 oxen fatting upon refuse from sugar-house, the dairy cows feeding on the same; sheep fed on the farm on cake, a breeding flock. 50 plough-horses in one stable, 7 saddle and carriage-horses in another, 5 three year old colts for saddle, and 4 one year old, all feeding on wheat straw, molasses, and a little hay: Mons. H. finds that oxen of five years old fatten quickly, better than at a younger age. At A——, a manufacturer of sugar assured me he lost 10,000 francs by the macerating process this season; it brings on fermentation, which is destructive of saccharine: the same person informed me that the

* 74° Reaumer, 198½° Farenheit.

inventor of the inclined plane had lost 30,000 francs by its adoption.

April 2d.—At A——. Mons. B.'s manufactory; sells his first and second quality sugar mixed, as *cane-sugar;* recalcines his animal carbon; his waste of this article has been but one-fourth of the quantity he purchased at the commencement of the season of crushing; it requires 3 lbs. of bones to make 1 lb. of prepared carbon, present price 16 francs per 100 lbs. Works his rasp for crushing by horses in a wheel, feeds them on beet-cakes, and sells them in the spring for more than he gave for them.

April 6th.—At the first manufacture of sugar in France, the crystallizing point was considered to be 32°, it then required many months to perfect it; now, twelve days are sufficient, as concentration is carried to 44°. The *American pump* is in use at the sugar-houses, and universally approved.

April 7th.—100 lbs. of beet-root contain 85 per cent. of juice. Specific gravity this day 6½°, requires 6 lbs. of lime to defficate;* after this operation, 1½°; after clarification, and when pumped into condenser, 23°. Size of defficating-pans, 4 ft. 9 inches diameter, 2 ft. 6 inches in depth, with a concave bottom; contain 225 gallons.

April 8th.—An experiment was made this day; the molasses was mixed with fresh sirop from the defficating-pan, as a person had said this would induce the molasses to crystallize—it would do no such thing.

April 28th.—Extract from a French paper. "The people about Berlin are gone beet sugar mad: the farmers are giving up the cultivation of grain, and are turning all their lands to the growth of sugar beet." This is in consequence of the report of Professor Shubarth on his return to Berlin, on the present state of the beet-sugar manufacture in France.

May 3d.—Beet-seed sowing not yet generally commenced; the season so wet and cold: no manure allowed for this crop, unless the land is exhausted by previous cropping; it is then sometimes dressed with pulverized oil cakes, 400 cakes per acre, at 10 francs, or $2 per 100.

May 4th.—Mr. R.'s account of the yield of 100 lbs. of beet-roots; 4 lbs. of first quality sugar, 2 lbs. of second quality, 1 lb. of third

* Deffication—adding of lime to the juice to destroy acid.

quality, 2 lbs. of molasses. The expense of extracting the one pound of sugar of third quality, great; it would, therefore be more profitable to give it, with the molasses, to cattle and sheep.

May 6th.—Visited a large manufactory in the neighbourhood of A., the working-horses on the farm fed with cut chaff, soaked in molasses and water, and oats; the working-oxen fed in the same way. Dairy-cows in excellent condition, fed with molasses and straw and beet-cakes.

May 9th.—Mem.—Lime is used in deffication, to neutralize the acid of the juice, and the use of acid in condensation is, to correct the lime, which might be in excess.

May 14th.—Sirop, for clearing, or washing sugar in pots, may be made, by reducing dry brown sugar with water to 21°, and clarifying it: then raise it to 33° while boiling, which will be 36 or 37 when cold; about a pint and half to be poured through flannel on the top of each pan, and suffered to flow out at bottom; one, two, or three washings to be given, as required.

May 16th.—At A. Mons. C. preparing sugar of third quality—he considers that, with less power than that which he has, it would be more profitable to give the molasses from second quality sugar to fatten cattle and sheep, than to extract third quality sugar from it: of this I too am satisfied, and prefer, therefore, to debit the cattle and sheep with third quality sugar in shape of molasses, and receive payment in shape of beef and mutton. Mem. It is a good practice to allow all animals, while confined to the house, plenty of salt.

May 18th.—At Mons. C.'s animal carbon works: all hands busy in reviving the old black of this season's working, (the crushing season ended on 27th April,) easily performed in a kiln built for the purpose: exposed to the fire 24 hours, and all is revived. The bottom pans, those exposed to the greatest heat, are filled with fresh bones, all the others have fresh bones at bottom, and a few mixed with the old black, as the pots are filled; the pots are then set one on another, four in height, and well luted with fire-clay, to prevent the escape of ammonia: the ammonia contained in the fresh bones is taken up by the old black, by which it is rendered equal to newly prepared carbon. Three times during the season, the old black is washed with muriatic acid, in the proportion of 1 to 100 of black in measure, by which it is cleared more effectually. Iron pots prefer-

able to those of earth, for this purpose; bones that have not been boiled, more valuable on that account.

May 18*th.*—The beet-growers admit that they make a profit of 300 francs per acre, if the crop is sold for 10 francs per 1000 lbs. The sugar manufacturers confess that a yield of 5 per cent. of sugar of first and second quality, gives them a certain degree of profit, yet not large. If a man grows 400 acres of beet, his profit upon his crop will be 120,000 francs, and if the yield of sugar be 6, 6½, or 7 per cent., the profit must be very ample upon the whole. Mem. In the estimate of profit upon the sugar business is included the profits upon *culture, sugar-making, cattle-feeding, and value of manure.*

May 19*th.*—At Mons. C.'s farm. Saw a field which had borne beet, either for seed or crushing, 15 years in succession, preparing for another crop: yield of seed per acre on an average, 1400 lbs. price at present, 20 cents per pound; last year it was 75 cents per pound, but if the tax be laid upon sugar extracted from the beet, it will not be worth more than 8 cents, as so many of the smaller manufacturers will be compelled to relinquish the business. At Quedlinburg in Germany, seed has risen to five times its customary price.

May 20*th.*—At Mons. P.'s farm, drilling beet in a field of 200 acres, in excellent order, a clover-lay, ploughed up before winter. The cultivation of the sugar beet, independent of the manufacture of sugar, is, perhaps, one of the most profitable concerns a man can be engaged in; for the feeding of sheep on a large scale, nothing could be more convenient and agreeable; confined in sheds during the winter, one man could attend to a great number. The magazine of roots might be placed near the sheds, and be easily protected from the severity of the winter; the roots might be given to the sheep without cutting or any previous preparation; shearing might be commenced as early as April, and the wool turned to account: early lambs could be reared to great profit, and the manure arising from such an establishment, would be invaluable as a top dressing to clover, part of which crop could be cut into chaff, with which the sheep might be fed in troughs, to great advantage. Saw again the sheep-pens of Mons. C., the mode of strewing the floors with lime, admirable management; sheep clean and healthy.

May 21.—At Valenciennes and neighbourhood. Mons. H. em-

ploys 100 women and men digging land with the spade—his fifty horses not sufficient to plough all the land required for the beet crop. Saw again the refinery of sugar belonging to Mr. B.; he does not consider the addition of acid, at the time of concentration, for the purpose of neutralizing an over dose of lime, as injurious, provided that no more be used than is necessary; this requires care and experience: considers the best conducted fabrics to be the most profitable. 52,000 lbs. of beet per acre an average crop in this part of the country. At Cambray, weather fine and all hands busily engaged in sowing beet; a woman with large boards fixed on her feet, walking over the land to save the expense of rolling!

The poetry of beet sugar making has gone out; it no longer is made to distil in lumps of double refined, and fall into your coffee without cost or labour, but it has left all that any sober-minded man had a right to expect. If three acres of beet can be cultivated at a profit of 900 francs, and yield 7,200 lbs. of sugar, 2,400 lbs. molasses, and 18,000 lbs. of cakes, sufficient food from the cakes and molasses to fatten sixty sheep, and raise manure for future crops, *all above this, must be mere poetry!*

May 24.—Farming at Mons. C.'s. The growth of beet seed has hitherto been of great importance: last year the price was 75 cents per pound; the average crop of seed 1400; one acre has brought 5000 francs; if the tax is laid on indigenous sugar, much of the land must be laid up to fallow, for want of manure to dress it: the manufacturers do not object to a tax, even of 15 per cent., if it be collected without the restrictions and vexations about to be imposed by the odious excise laws; it would not be possible for one in five to conform to the regulations proposed: the result will be, the ruin of hundreds of small manufacturers, sugar will rise to double the price, and the people will be again debarred the use of an article, which is no longer one of luxury but almost of necessity; much of the common beverage of the country is sugar and water.

May 25.—Visited Mons. P.'s oil mill, the completest in the country; steam-engine twelve horse power; all the works contained in one room, cost of machinery and building, £4000 sterling. Engaged crushing poppy seed and extracting oil. One acre of land will yield 800 quarts of poppy seed; the same land will yield from 800 to 1000 quarts of wheat: price of poppy seed, 28 francs per 100 quarts; four quarts

of seed give one quart of oil, or 25 per cent.—three-fourths of first quality, or cold drawn, one-fourth of second quality: price of oil of first quality, $22.40 per hectolitre, or 105 quarts, including the cask; price for second quality, $21.20. The first quality is used as salad oil, either alone, or mixed with olive oil; most part of what is made goes to the south, where it is mixed with olive oil, and is then sent to Paris as genuine olive: the second quality is sent to Marseilles for making the finest soap; it is also used for burning in lamps. The seed yields most oil when cultivated on a soil not too highly manured; the crop is substituted for a fallow, when the land is exhausted. Seed is sown in April, the earlier, if no frost, the better, as new seed obtains good prices in the market. Quantity of seed to be sown per acre four quarts, either drilled or broadcast, harvested in July or August. Crop to be kept clean by hoeing. At harvest, the plants are carefully pulled, bound in small bundles and set to dry; when quite dry, a woman takes a bundle in each hand and shakes the heads into a sheet; they are then set up again, and have another shaking after another drying, and the seed is cleared in the field, when it is at once fit for the market and for crushing, an operation which is performed in a few minutes. The cultivation of the poppy is neither laborious or expensive, ranks next to the beet in point of profit, and the ease with which it is harvested, and the facility with which the crop may be turned into money, are amongst the strongest of its claims to notice. The stalks are of no use but to burn, and return little to the land in the shape of manure, but the cakes, which remain after the oil is expressed, are valuable food for cattle and sheep, and are sold for $2 per 200 lbs.—the quantity of cakes per acre about 150 lbs. These cakes, when ground and prepared, are used to adulterate chocolate, for which it is a good substitute; much of the chocolate used in France is thus adulterated: the pulverised cake is used for manure, being drilled with other seeds with great success.

May 26.—A farmer, who rented land at 40 francs per acre, has just consented to give a rent of 150 francs per acre for the same land, to grow beets, rather than give it up. A person advertises his house and lands rent free for twenty years, to any person of capital, who will establish upon it a sugar manufactory, and cultivate the beet in the customary way. The proprietor of a large

estate in this immediate neighbourhood, on which is erected a very large sugar manufactory, with steam-engine, steam-boilers, &c. has just let the whole to a person of property; buildings and apparatus complete, with all necessary machinery, for carrying on a very extensive business, *rent free*, the tenant binding himself to purchase of the proprietor all the beets which he can raise upon the farm, at 10 francs per 1000 lbs., by which he will soon realize a fortune.

May 26.—So soon as the beet crop is fit to take up, is the time to purchase sheep and cattle for feeding; they are kept in the fields to feed upon the leaves and cuttings of the roots while taking up, but they are not permitted to stray over and tread on them, but are attended by the shepherd, and are driven to the sheds for the night. After the leaves are expended the sheep are confined to the sheds, when they grow fat in a short time, having plenty to eat and being prevented from roaming abroad. The sheds are divided by partitions, and about 30 sheep are put into each, those in best condition nearest the upper end of the building. When this first lot is sold to the butcher, the second lot takes possession of the pen, and a general remove takes place; a fresh lot is entered at the lower end and is brought up in succession, so that it is pleasing to witness by entering at the lower end, the different degrees of the condition of the flock as you proceed upward, and you can thus ascertain to a certainty, whether they are making a regular progress towards the butcher.

May 27.—At Valenciennes is the place where chicory is grown for dying; the roots are white and of the shape of the carrot, these are cut into small square pieces and baked until they attain a fine brown colour, they are then ground in a mill, and sent to the countries in which the dying is performed; the taste is extremely acrid and unpleasant, and yet large quantities are used in coffee, for what purpose it is not easy to conceive; purchased some seed.

May 28.—Leopold, king of Belgium, and son-in-law of the king of the French, in expectation of the tax upon beet sugar in France, has invited the cultivators of that crop to settle in his kingdom, where they will meet with every encouragement, and be furnished with a guarantee of freedom from taxation in their business; many are going thither, a fine country and excellent land for the purpose.

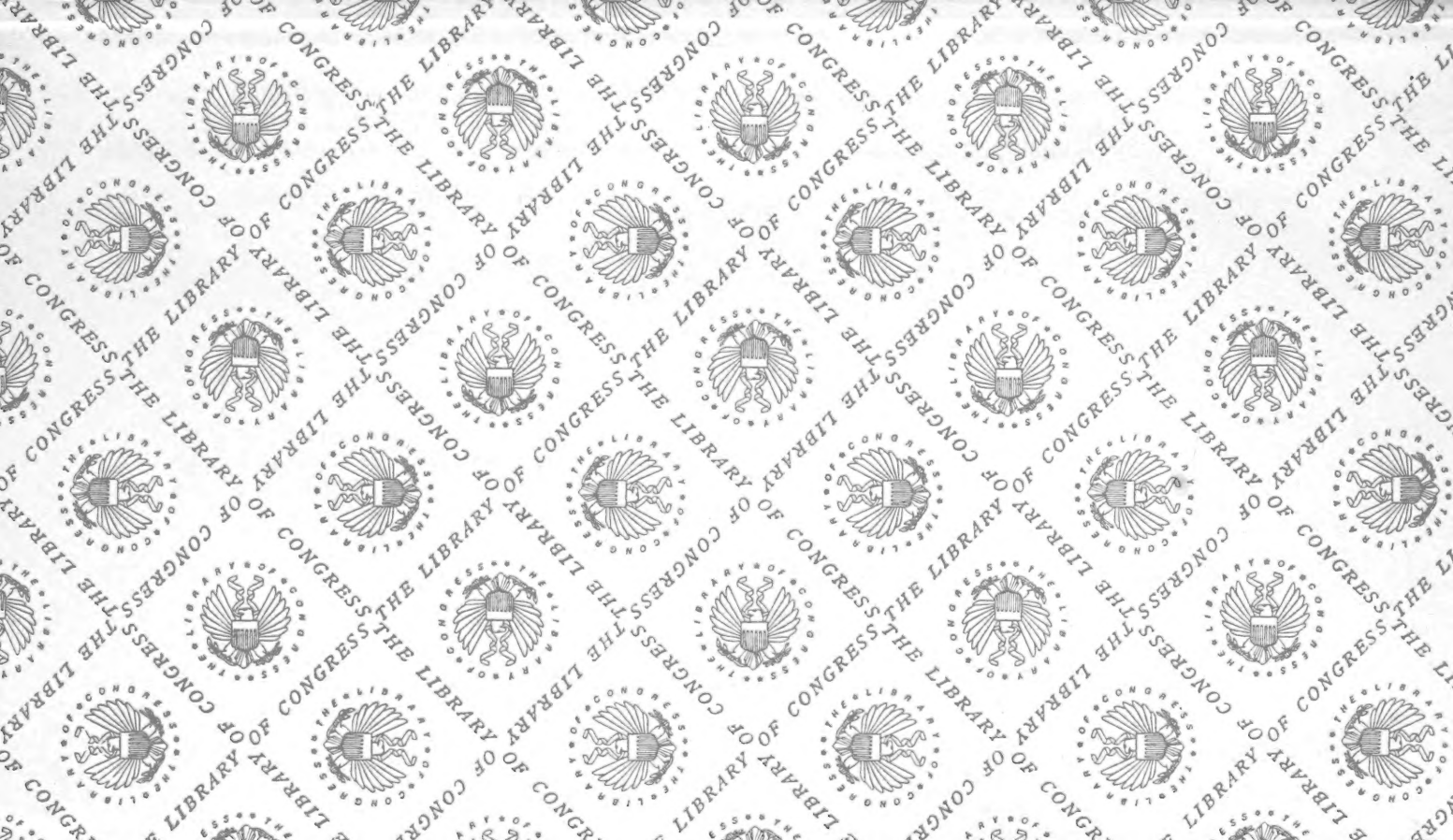
Extracts from French papers.—"However desirable it may be to

preserve or to favour the colonies, the time of their exclusive supply of the market with sugar is gone by ; this species of cultivation now naturalized in 36 departments of France, is well worth the produce of three islands lost in the bosom of the ocean ; to prefer the latter to the former, would be about as reasonable as to adhere to the use of bows and arrows after the invention of gunpowder." "The making of beet sugar, for which the population of France has shown a wonderful aptitude, is a kind of *godsend* that should be taken advantage of for the uniting together of agricultural and manufacturing art. The whole system of the law for imposing duties on beet sugar is bad, it starts from false ideas, and leads to most lamentable results."

May 29.—The production of sugar from the beet is not the only or the most valuable result to be derived from its cultivation; it would appear, that almost as much stock can be kept upon the refuse of an acre of beet as upon the crop before crushing ; this is accounted for by the circumstance of the extreme palatableness of the molasses, which turns to the most delicious food, what was once considered fit only for the bedding of cattle. The spirit of industry which it engenders, and the power of reproduction which is contained in the large quantities of manure arising from such a system of feeding, are amongst the first of its advantages, while the increase in the value of land suitable to the growth of so invaluable a crop, must be of primary importance. America is destined to take the lead in the production of silk and sugar, as she has already done in cotton, rice and tobacco.

The Society purpose to order seed from France for the next year's growing here. Orders transmitted to the Secretary and Treasurer, with proper security guaranteed for payment, will be attended to.

MB-285.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